

Global Veterinaria 9 (4): 441-446, 2012

ISSN 1992-6197

© IDOSI Publications, 2012

DOI: 10.5829/idosi.gv.2012.9.4.65174

Bovine Mastitis and Associated Risk Factors in Small Holder Lactating Dairy Farms in Hawassa, Southern Ethiopia

¹Nibret Moges, ¹Tekle Hailemariam, ²Tewodros Fentahun,
³Mersha Chanie and ²Achenef Melaku

¹Department of Veterinary Clinical Studies, Faculty of Veterinary Medicine,
University of Gondar, P.O. Box 196, Gondar, Ethiopia

²Department of Basic Veterinary Science, Faculty of Veterinary Medicine,
University of Gondar, P.O. Box 196, Gondar, Ethiopia

³Department of Veterinary Paraclinical Studies, Faculty of Veterinary Medicine,
University of Gondar, P.O. Box 196, Gondar, Ethiopia

Abstract: A cross sectional study was conducted from November 2008 to April 2009 in Hawassa town, southern Ethiopia to determine the overall mastitis prevalence and identify the role of potential risk factors in 183 randomly selected small holder lactating dairy cows of 53 high grade Holstein Friesian, 113 Holstein-indigenous zebu cross and 17 indigenous zebu breeds. Of the total 183 lactating smallholder dairy cows examined for bovine mastitis 9(4.9%) had clinical mastitis, while 56(30.6%) subclinical mastitis. Out of 9 (4.9%) clinical mastitis, 9.43 and 3.53% occurred in high grade Holstein and Holstein-indigenous zebu, respectively but indigenous zebu breeds was found not affected. Among the potential risk factors considered, breed ($P^2=17.3$, $P<0.05$), presence of teat lesion and/or tick infestation ($P^2=7.73$, $P<0.05$), stage of lactation ($P^2=13.8$, $P<0.05$) and parity number ($P^2=19.4$, $P<0.05$) had significant effect on the prevalence of subclinical mastitis. Considering the possible significant economic losses that could be incurred by both clinical and subclinical mastitis, attention should be paid for further detailed investigation and control measures.

Key words: Bovine Mastitis % Hawassa % Prevalence % Risk Factors

INTRODUCTION

There are several types of diseases which potentially infect and affect the wellbeing of livestock population among which mastitis is the common and costly disease causing loss in milk yield, treatment cost for dairy farmers. Mastitis is considered as the most complex disease because of its multifactorial causation [1]. Despite of many years of research mastitis remains the most economically damaging disease for the dairy industry worldwide and it has also public health importance by serving as a vehicle in the spread of diseases like tuberculosis, staphylococcal food poisoning and brucellosis [2]. Food poisoning is produced when milk, milk products, or food prepared with milk products containing strains of bacteria associated with food poisoning is stored at temperature that enhance rapid multiplication of the

organisms. Some staphylococci that cause mastitis may also produce the enterotoxin [3].

According to the study carried out in England and Wales from 1989 to 1992, the average cost of a case of mastitis due to antibiotics used, milk discarded, reduction in quality and quantity of milk produced by a cow was estimated 60 pounds for each case [4] and the economic loss due to both clinical and subclinical mastitis per lactation in Ethiopia is 270 ETB [5]. Based on the research works showed that on the average the affected quarter suffers a 30% reduction in productivity and affected cow a 15% loss its production [6].

According to the reports of FAO [7] the total annual national milk production in Ethiopia ranges from 797,900 to 1,197,500 metric tons of raw milk. Out of total national milk production, between 85 and 89% is contributed from cattle. However, this amount is by far below the national

Corresponding Author: Nibret Moges, Department Of Veterinary Clinical Studies, Faculty of Veterinary Medicine,
University of Gondar, P.O. Box 196, Gondar, Ethiopia.

demand for milk and milk products in the country. Many reasons could be ascribed for the low annual national milk yield among which mastitis is one of the most important factors. A number of reports indicated that mastitis is a serious problem in the dairy industry of Ethiopia. Nesru [8] reported a mastitis prevalence rate of 85.8 and 81.2% using California Mastitis Test (CMT) and Somatic Cell Count (SCC), respectively. According to the same report out of the CMT positive animals; 37.2% did harbor a causal agent for mastitis. Biru [9] reported a combined bovine mastitis prevalence of 67.4% at cow level while Bishi [10] reported a subclinical mastitis prevalence of 35.5 and 34.3% for small and large scale farms, respectively.

Mastitis as a disease has received little attention in Ethiopia, especially the subclinical form. Efforts have only been concentrated on the treatment of clinical cases [8]. Bovine mastitis is the most important disease condition of dairy cows. Owing to the heavy financial implications involved and the inevitable existence of latent infections, mastitis is obviously an important factor that limits dairy production.

Very limited researches have been done concerning on the status of bovine mastitis in Hawassa City unlike that of other areas of the country [7]. The study area is one of the most known potential dairy areas in the country, where smallholder dairy production is practiced. Therefore, this study was designed with the objectives of estimating prevalence of bovine mastitis in smallholder lactating dairy cows and assessing mastitis occurrence with potential risk factors.

MATERIALS AND METHODS

The Study Animals: The study animals that had been sampled were lactating smallholder dairy cows of different herds with different calving history and management conditions. The study animals were high grade Holstein Friesian, predominantly Holstein-indigenous zebu cross breeds and indigenous local zebu lactating cows in smallholder farms. The average herd size was 5.5 and the maximum was 23 lactating cows of large scale dairy farm. According to the census result of CSA [11], the total cattle population of Sidama Zone is estimated to be 1,573,318 cattle. Regarding the management system; only two farms was on an intensive management but the rest were under a semi-intensive and extensive management type. Local zebu lactating cows were kept in a traditional-extensive husbandry system and their feeds were entirely dependent on the nature pasture and agricultural

byproducts. A total of 183 smallholder lactating cows were examined from 24 smallholder dairy farms in Hawassa City, Sidama zone, SNNPR Regional State.

Study Methodology: A cross sectional type of study was conducted to determine the prevalence of bovine mastitis. The study was carried out from November 2008 - April 2009 in 183 randomly selected smallholder lactating dairy cows. Both clinical and subclinical mastitis prevalence was determined cross-sectional at cow and quarters level based on clinical examination for clinical mastitis and Indicator Paper Test (PT) for subclinical mastitis. Sample size was determined according to Thrusfield [12] at 95% CI, 5% precision and with expected prevalence of 38% [13]. A total of 183 smallholder lactating dairy cows; 17 indigenous local zebu, 113 Holstein Friesian-indigenous zebu cross and 53 high grade Holstein, relatively under the same management were included in the study.

Clinical Examination of Mastitis: To determine prevalence of clinical mastitis udder was examined for visible abnormalities, symmetry, size, consistency, presence of lesions and/or ticks. Clinical mastitis was recognized by some pathology in udder, which is manifested by swelling, pain, redness and heat in case of acute mastitis. Whereas, hardening of the udder, blockage of the teats, atrophy or fibrosis and abscess formation were manifested in chronic mastitis. Acute mastitis was also recognized by change in milk color, presence of flakes and clots.

Indicator Paper Test: To determine prevalence of subclinical mastitis the milk samples were screened using indicator paper. It was carried out by adding a drop of milk sample to the test paper and observing the color change of the paper. If yellow color of the paper is not changed and remained as it is or showed slight change, such sample was considered as negative. A change of color from yellow to green or bluish green was recorded as positive.

Risk Factors: Semi structured questionnaire was compiled to evaluate the effect of selected potential risk factors on the occurrence of mastitis. Risk factors considered at cow attributes were breed (high grade Holstein-Friesian, Holstein indigenous zebu cross breed and indigenous zebu breeds), parity, stage of lactation (early, middle and late) and the presence/absence of tick or lesion or udder injury on udder skin or teat and previous mastitis history. The stage of lactation was

categorized into three levels as 1- 120 days post partum (early lactation), 121- 240 days (middle lactation) and days greater than 240 (late lactation) and similarly parity was categorized as #3 calves birth, 4 - 7 calves and > 7 calves.

Data Analysis: Prevalence of bovine mastitis related to specific risk factors was determined as the proportion of affected cows out of the total examined [12]. Effects of specific variables including breed, age, parity, tick infestation, udder injury and or teat injuries, stage of lactation and previous history of mastitis were investigated using chi-square and these were calculated to assess the risk levels of categories under each risk factor and analyze using Stata 7 statistical software package. In all chi-square test application, probability of $p < 0.05$ was considered statistically significant.

RESULTS

Prevalence of Clinical and Subclinical Mastitis: Among 183 lactating cows examined in small holder dairy farms in Hawassa town, SNNPR State for Bovine mastitis 9 (4.9%) had clinical mastitis. Out of 9 (4.9%) clinical mastitis, 9.43% occurred in high grade Holstein and 3.53% Holstein

indigenous zebu cross and none clinical mastitis was observed in indigenous zebu breeds. Based on indicator paper test subclinical mastitis prevalence was 30.6% (56/183) at cow level (Table 1).

At quarter level out of 732 quarters belonging to 56 cows, 104 (14.2%) were found to be affected by subclinical mastitis. The occurrence of subclinical mastitis by quarter location was 24 (23.07%), 27(25.9%), 26(25%) and 27(25.9%) in the left front (LF), right front (RF), right hind (RH) and left hind (LH), respectively (Table 2). The difference in prevalence between the quarters was not statistically significant ($P^2 = 19.4$, $P > 0.05$).

Risk Factors Associated with Sub-Clinical Mastitis:

The prevalence of subclinical mastitis was significantly higher in high grade Holstein-Friesian (32.07%) than Holstein indigenous zebu cross bred (30.9%) and indigenous zebu (23.52%) ($P^2 = 17.3$, $P < 0.05$), in cows with a lesion and/or tick infestation on the skin of the teat and/or udder than in cows without these factors ($P^2 = 7.73$, $P < 0.05$), cows with high number of calves (4-7) (58.5%) than those of cows having less (1-3) calves (22.5%) ($P^2 = 19.4$, $P < 0.05$), in late lactation (50.0%)

Table 1: Prevalence of clinical and subclinical mastitis at cow and quarter level in the examined smallholder lactating dairy cows

Observation level	Clinical mastitis			Subclinical mastitis		
	No examined	Positive	%	No examined	Positive	%
Cow level	183	9	4.9	183	56	30.6
Quarter level	732	20	2.73	732	104	14.2

Table 2: Prevalence and distribution of udder infection across the four quarters in dairy cows

	Clinical mastitis		Subclinical mastitis	
	No of quarters examined	Prevalence	No of quarters examined	Prevalence
No of quarters affected	200	27.3%	104	14.2%
Front left	3	15%	24	27.07%
Front right	6	30%	27	25.9%
Hind left	5	25%	27	25.9%
Hind right	6	30%	26	25.0%

Table 3: Prevalence of subclinical mastitis with associated risk factors

	Breed			Stages of lactation (days)			Parity No.		Lesions/ udder injuries		Tick infestation	
	HF	HIZ	Z	Early	Mid	Late	Calves (1-3)	Calves (4-7)	+	-	+	-
Cows												
Examined	53	113	17	66	67	50	142	41	9	176	10	173
Infected	17	35	4	14	17	25	32	24	7	49	7	49
Prevalence (%)	32.07	30.9	23.5	21.2	25.3	50	22.5	58.5	77.7	27.8	70	28.3

Where; HF = Holstein Friesian, HIZ = Holstein indigenous zebu cross, Z =Indigenous zebu, += present, - = absent.

Table 4: Significant risk factors of bovine subclinical mastitis

Variables	P ²	p-value
Breed	17.3	0.05
Stage of lactation	13.8	0.001
Parity	19.42	0.01
Presence of tick/or udder injury	7.73	0.005

than mid lactation (23.37%) and early lactation (21.2%) ($P^2 = 13.8$, $P < 0.05$). In the present study from selected potential risk factors breed ($P < 0.05$), stage of lactation ($P < 0.05$), parity ($P < 0.05$) and presence of tick and/or udder injuries ($P < 0.05$) had statistically significant effect (Tables 3 and 4), but others selected risk factors had no significant effects in the prevalence of sub-clinical mastitis ($P > 0.05$).

DISCUSSION

This study has given a due attention to determine the prevalence and its risk factor assessment for bovine mastitis. Bovine mastitis 9 (4.9%) had clinical mastitis, while 56 (30.6%) were subclinical mastitis cases. Out of 9 (4.9%) clinical mastitis, 9.43% occurred in high grade Holstein and 3.53% Holstein indigenous zebus cross and none clinical mastitis was observed in indigenous zebu breeds. Based on indicator paper test subclinical mastitis prevalence was 30.6% at cow level.

The overall prevalence of clinical mastitis in this study was 4.9% which is comparable to the reports done in different dairy farms: in Diredawa Autonomous and East Hararge Administration Regions (3.54%) by Daresema [14]; in and around Gondar (4.4%) by Tewedros [15]; in and around Mekelle (6.55%) by Wudu [16]; in three states dairy farms around Addis Ababa (7%) by Yirgalem [17]; in Bahir Dar (3.9%) by Gizat *et al.* [18] and in central high lands of Ethiopia (6.6%) by Mungube *et al.* [5]. While it was lower in the reports done in Welayta Sodo, Southern Ethiopia (15.1%) by Biffa [19]; in and around Sebeta in Ethiopia (16.11%) by Hunderra *et al.* [20]; in dairy farms in Dire Dawa Administrative Council and Eastern Hararghe Zone (19.8%) by Birhanu [21]; in two major state owned dairy farms at Rapi and Debre Zeit, Ethiopia (21%) by Workineh *et al.* [22] but it was a far lower in the research finding in selected areas of southern Ethiopia (37%) [23].

Subclinical mastitis was high in all breeds compared to clinical mastitis. The prevalence of subclinical mastitis at cow level based on indicator paper test in the present study (30.6%) was comparable to the reports done in

different dairy farms: in Bahir Dar (34.4%) by Gizat *et al.* [18]; Bishi [10] who reported (34.3%); Abaineh and Sintayehu [24] (34.6%); Sori *et al.* [25] (45.4%) in commercial farms in Ethiopia. But the present finding is by far lower than the reports of Kerro and Tarekegn [23] in local, Friesian and Jersey cows in Ethiopia (63%); Machang and Muyungi [26] in Tanzania (67%) and Kivaria *et al.* [27] in lactating cows in smallholder farms in Tanzania. Mastitis is a complex disease and the difference in results could be due to variations in herd size, management practices, proportion of exotic gene inheritance, agro-climates and other risk factors might have contributions to the observed differences in prevalence rates of mastitis among the findings of the various workers.

The significant difference between the high grade Holstein-Friesian, Holstein indigenous zebu crossbred and indigenous zebu might be associated with their high milk yield. Radostits *et al.* [2] recently stated that high yielding cows are more susceptible to mastitis than low-yielding ones. This may be due to the ease with which injuries are sustained in large udders, so that foci for the entrance of pathogens are created and stress associated with a high milk yield may upset the defense system of the animal. On the other hand, this difference between breeds might be due to other uncontrolled factors, such as management, rather than to a true breed difference, since cows in this study were not all under the matching conditions. Further study is required to evaluate the breed difference.

The significant effect of stage of lactation on prevalence of subclinical mastitis in this study was (21.2), (25.37) and (50.0%) in early, mid and late lactation, respectively, also reported by Nesru [8], Mungube *et al.* [5], Kerro and Tarekegn [23] and Biffa *et al.* [19] in Ethiopia. The former two authors reported high prevalence of sub-clinical mastitis for cows in mid and late stage of lactation as it is the case in this finding, while the late two reported higher prevalence in early stage of lactation. The variations in the effect of stages of lactation between the difference studies could be related probably to the disparities in age, parity and breed of the sampled animals.

Animals with skin lesions on their teats and/or udder had a high prevalence of mastitis, possibly because of colonization of the lesion by pathogens. Mulei [28] found, in the Kiambu district of Kenya, that mammary gland quarters with teat lesions were 7.2 times more likely to have a positive CMT and 5.6 times more likely to have bacterial organisms isolated from them than those

without any teat lesions. In this study, the prevalence of sub-clinical mastitis was significantly higher in cows with teat lesions. Similar finding were reported by Sori *et al.* [25]. Kerro and Tarekegn [23] and Biffa *et al.* [19] reported that the prevalence of sub-clinical mastitis was significantly higher in cows with teat lesions.

Parity was found a significant influence on the prevalence of subclinical mastitis. Cows with many calves (4-7) were point prevalence of (58.5%), than those of cows having (1-3) calves (22.5%). The risk of subclinical mastitis increases with increasing parity. Concerning this, results of this study agree with the research findings by Sargeant *et al.* [29] and by Busato *et al.* [30], who found that the risks of clinical and subclinical mastitis increase significantly with advancing age of the cow, which approximates to the parity number.

In Ethiopia, the subclinical form of mastitis received little attention and efforts have been concentrated on the treatment of clinical cases [31]. According to Mungube *et al.* [5] losses associated with sub-clinical mastitis (SCM) in cross-bred dairy cows in the central high land of Ethiopia was found to be US\$ 38 for each cow per lactation. Usually Ethiopian farmers specially smallholders are not well informed about the invisible loss from sub-clinical mastitis as reported by Hussein [31] and were also true in Tanzanian farmers [27].

Bovine mastitis is the important disease which affects the profitability of the dairy industry. The overall cow level 30.6% and quarter level 14.2% prevalence of mastitis in the present study signify the effect of mastitis in Hawassa dairy farming. The occurrence of mastitis was found to be associated with breed, parity, stage of lactation and presence of teat and/or udder lesions. Adequate housing with proper sanitation and regular screening for early detection and treatment, follow up of chronic cases, culling of older cows with repeated attacks should be presented and practiced by the owners.

ACKNOWLEDGEMENT

The authors are grateful for the financial support of Gondar University and staff members of Hawassa University and Veterinary clinic for their help in sample collection.

REFERENCES

1. Harmon, R.J., 1994. Symposium: Mastitis and genetic evaluation from somatic cell count. Dairy Science, 7: 2103-2112.
2. Radostits, O.M., C.C. Gay, K.W. Hinchchiff and P.D Constable, 2007. A Text book of the Disease of cattle, sheep, pigs and goats. 10th ed. London: Ballieer, Tindall.
3. Hirsh, D.C. and Y.C. Zee, 1999. Veterinary microbiology. 2nd ed., Blackwell science.
4. Blowey, R.W., 1990. Mastitis and Conditions of the Udder. In: A veterinary Book for Dairy Farmers. 2nded. pp: 181-229.
5. Mungube, E.O., B.A. Tenhagen, F. Regassa, M.N. Kyule, Y. Shiferaw, M.P.O. Kassa and L. Baumann, 2005. Reduced Milk Production in Udder Quarters with Subclinical Mastitis and Associated Economic Losses in Crossbred Dairy Cows in Ethiopia. Journal of Tropical Animal health and Production, 37: 503-512.
6. Blood, D.C. and O.M. Radostits, 1989. Mastitis. In: Veterinary Medicine. A Text Book of the Disease of cattle, Sheep, Goat and Horses, 7th ed. London: Bailliere Tindal, pp: 501-599.
7. FAO, 2003. Livestock Sector Brief. Livestock Information, Sector Analysis and Policy Branch, pp: 1-15.
8. Nesru, H., 1999. A cross-sectional and longitudinal study of bovine mastitis in urban and peri-urban Dairy System in the Addis Ababa region, M. Sc. thesis, Free University of Berlin and Addis Ababa University, Ethiopia.
9. Biru, G., 1998. Major bacteria causing bovine mastitis and their sensitivity to common antibiotics. Ethiopia Journa. Agricultural Science, 11: 47-54.
10. Bishi, A.B., 1998. Cross-sectional and Longitudinal Prospective Study of Bovine Clinical, Subclinical Mastitis in Pen-urban and Urban Dairy Production System in, Addis Ababa Region. Msc Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre- Zeit, Ethiopia.
11. CSA., 2003. Ethiopia Agricultural sample enumeration results for South region.
12. Thrusfield, M., 2005. Veterinary Epidemiology. 3rd ed. Singapore; Black well Science.
13. Demelash, B., D. Etana and B. Fekadu, 2005. Prevalence and risk factors of mastitis in lactating dairy cows in southern Ethiopia. International. Journal. Appel. Reset. Veterinary Medicine, 3(3): 232.
14. Daresema, G., 1991. A Survey of bovine mastitis in different dairy farms of Dire-dawa Autonomous and East Harareghe Administrative Region, DVM thesis, Addis Ababa University, Faculty of Veterinary Medicine. Ethiopia.

15. Tewedros, 2007. Prevalence and economic significance of bovine mastitis in and around Gondar. DVM thesis Mekelle University Faculty of veterinary medicine, Ethiopia.
16. Wudu, T., 1999. Study on bovine mastitis in and around Mekelle. DVM thesis, Addis Ababa University, Faculty of Veterinary Medicine, Ethiopia.
17. Yirgalem, G., 1987. A survey on the prevalence and etiology of bovine mastitis in three state dairy farms around Addis Ababa. DVM thesis, Addis Ababa University, Faculty of Veterinary medicine. Ethiopia.
18. Gizat, A., A. Zerihun and Y. Asfaw, 2007. Bovine mastitis and its association with selected risk factors in smallholder dairy farms in and around Bahir Dar, Ethiopia. *Ethiopian Veterinary Journal*, 13: 23-26.
19. Biffa, D., M. Debela and F. Beyene, 2005. Prevalence and risk factors of mastitis in lactating dairy cows in southern Ethiopia. *International Journal. Appl. Reser. Veterinary. Medicine*, 3: 189-198.
20. Hunderra, B., D. Etana, Z. Ademe and A. Sintayehu, 2005. Dairy cattle mastitis in and around Sebeta, Ethiopia, *International Journal. Appl. Reser. Veterinary Medicine*, 3(4): 432.
21. Birhanu, S., 1997. Bovine Mastitis in Dairy Farm in Dire Dawa Administrative Council and Western Harareghe Zone. Prevalance, isolation and *in vitro* antimicrobial susceptibility study DVM thesis. Addis Ababa University', Faculty of Veterinary medicine. Ethiopia.
22. Workineh, S., M. Bayleyegne, H. Mekonnen and L.N.D. Potgieter, 2002. Prevalence and etiology of mastitis in cows from two major Ethiopian dairies. *Journal of Tropical Animal Health and Production*, 34: 19-25.
23. Kerro, O. and F. Tarekgn, 2003. Bovine mastitis in selected areas of Southern Ethiopia. *Journal of Tropical Animal Health and Production*, pp: 197-205.
24. Abaineh, D. and A. Sintayehu, 2001. Treatment trial of subclinical mastitis with the herd presicaria seneglense. *Tropical Animal Health and Production*, 33: 511-519.
25. Sori, H., A. Zerihun and Abdicho, 5. 2005. Dairy cattle mastitis in and around Sebeta. *Ethiopia International journal Appl. Res. Vet. Med.*, 3: 332-338.
26. Machang, U.R.S. and L. Muyungi, 1998. The occurrence of streptococci mastitis in dairy farm in Morogoro area, Tanzania. *Bulletin of Animal health and Production in Africa*, 36: 190-193.
27. Kivaria, F.M., J.P.T.M. Noordhuizen and A.M. Kapaga, 2004. Risk indicators associated with subclinical mastitis in smallholder dairy cows in Tanzania, *Journal of Tropical Animal Health and Production*, pp: 581-592.
28. Mulei, C.M., 1999. Teat lesions their relationship to intramammary infections on small- scale dairy farms in Kiambu district in Kenya. *Journal of the South Africa Veterinary Association*, 70: 156-157.
29. Sargeant, J.M., M.M. Scott, K.E. Leslie, Ireland and M.J.A. Bashiri, 1998. Clinical mastitis in dairy cattle in Ontario: frequency of occurrence and bacteriological isolates. *Canadian Veterinary. Journal*, 11: 33-38.
30. Busato, A., P. Trachsel, M. Schallibaum and J.W. Blurn, 2000. Udder health and Risk Factors for Subclinical Mastitis in Organic Dairy Farm in Switzerland. *Preventive Veterinary Medicine*, 44: 205-220.
31. Hussein, N., 1999. Cross sectional and longitudinal study of bovine mastitis in urban and peri urban dairy systems in the Addis Ababa region, Ethiopia. MSc Thesis, Addis Ababa University, Faculty of Veterinary Medicine, School of Graduate Studies.